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# Teaching Science as Practice in Middle School

Jennifer Hicks, Ph.D.  
Science Curriculum Specialist

# Indiana Department of Education

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Science Curriculum Specialist

Jennifer Hicks, Ph.D.

[jhicks@doe.in.gov](mailto:jhicks@doe.in.gov)

(317)232-9185



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# What Role Should Science Play in Middle School?

- An introduction to more “serious” science investigations?
- A preparation for high school science?
- An acceleration for high school science (biology as 8<sup>th</sup> graders)?
- What are we preparing students for????



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# Obstacles to Teaching Science

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- Many elementary and middle school teachers find it difficult to teach inquiry-based science in their classrooms.
- External vs. internal factors
- What do you foresee as obstacles?



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# Why Teach Inquiry-Based Science?

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- Science can provide a foundation for development of problem-solving and critical-thinking skills.
- Modeling daily activities of scientists gives realistic and effective instruction



# Where should curriculum begin?

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- Standards (Core Standards)= the intended curriculum
- Provide the limits for the content
- Provide goals or expectations around which to organize instruction



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# *Indiana's Academic Standards for Science Revision*

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- Revision process began in fall, 2008
- Committees of teachers, teacher educators and scientists met to draft revisions
- Goal is to have the revised standards approved by the State Board of Education in late 2009/early 2010



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# Indiana's Core Standards

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- The **Core Standards** build upon *Indiana's Academic Standards* by integrating multiple Standards Indicators into a small number of instructionally coherent targets.
- Simple language – smaller number of important topics



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# Indiana's Core Standards

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- The **Core Standards** give proper weight to concepts central to advancement across subsequent grade levels.
- Learning Progressions (progression in concepts from grade to grade)



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# Core Standard-Grade 6

- *Describe with models or drawings how the earth's tilt on it axis relative to the plane of the earth's yearly orbit around the sun is responsible for seasonal weather changes.*
- Content limits of standard
  - Earth's tilt on it's axis-direction, not cause
  - Northern and Southern hemispheres
  - Position of earth (orbit) relative to sun at given times of year relative to seasons



# Learning Progressions

- Prior to 6<sup>th</sup> grade what do students know about earth systems?
  - Position of sun, moon, stars, relative to earth
  - Changes in appearance of moon
  - Changes in length of day/night and temperature variations throughout year
  - Cause and effect relationships between human activity and seasons
- Very little depth of understanding about underlying mechanisms



# The Big Picture

- Create a meaningful problem:  
What causes the seasons?
- How does this concept connect with the rest of the curriculum?

Science: Core Standard 5: Energy from the sun is transformed by plants...



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# What does “science as practice” look like?

- Phase 1

Determine prior knowledge, provide necessary background, build motivation

**\*\*Very important to reveal misconceptions and begin to develop strategies to address these.**



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# Revealing Misconceptions

- **MOSART:** Misconceptions Oriented Standards-based Assessment Resource for Teachers (<http://mosart.mspnet.org/>)
  - Available for Earth and Physical Science now
  - Life Science available in 2010
- **A Private Universe** (Earth Science 5<sup>th</sup>-12<sup>th</sup>)

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<http://www.learner.org/teacherslab/pup/>

# Science as Practice *cont.*

- Phase 2: Gather information, initial hypotheses, work with small set of data
- Build appropriate skills and knowledge “just in time” and in context
  - For example: present students with a problem that allows them to collect data about seasonal changes in sun position, incidence of sun
  - National Digital Science Library Middle School portal

<http://msteacher.org/epubs/science/science7/science.aspx>



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# Science as Practice cont.

- Phase 3: Investigate the data, generate and critique explanations for observations
- Phase 4: Present and discuss findings, prepare reports, analyze key points



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